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CERTIFIED TRANSLATION CERTIFICATE TO ACCOMPANY GERMAN TO ENGLISH TRANSLATION OF THE ATTACHED PATENT DOCUMENT

I, Raquel Fleming, Translation Department Manager of University Translators Services, LLC, (ATA NUMBER: 231264) attest to the fact and certify that this document has been officially translated into English from the German original as well as certify that the translation is true and accurate and that the translator is certified and competent.

Raquel Fleming — May 16, 2006

Signature *Date*

Raquel Fleming personally appeared before me on the 16th day of May 2006 in Ann Arbor, Michigan, Washtenaw County, U.S.A.

Susan M. Otto

Susan M. Otto, Notary Public
State of Michigan, County of Washtenaw
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My commission expires March 27, 2007

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Translator's notes:

The text uses "Steurscheibe" and "Steuerkurve" interchangeably. These were rendered as "disk cam" and "radial cam" respectively.

The following terms could not be verified and were rendered by their roots:

Ansteuerrampe	trigger ramp
Antriebsverbindung	drive connection
Aussteuerfläche	drive-out surface
Aussteuerrampe	drive-out ramp
Eingriffsbereich 16	engagement region
Einsteuerfläche	insertion surface
kallottenförmig	dome-shaped
Kraftbegrenzungseingrichtung	force-limiting device
Kugelstraffer	sphere tensioner
Kupplungsansatz 12	coupling neck
Lagerausnehmung 27	mounting recess
lagerbereich 15	mounting region
Lagerfortsatz 13	mounting extension
Massekugel	mass sphere
Straffbewegung	coupling movement
Straffvorrichtung	tensioner device
Wellenfortsatz 11	shaft extension
zwangsgesteuert	forcibly controlled

Seat-belt tensioner with a belt coupling which can be actively disconnected

Description

The invention relates to a seat-belt tensioner comprising a belt retractor and a belt drive which can be coupled to a belt shaft thereof by means of a tensioner coupling, said tensioner coupling comprising of at least one coupling latch movably arranged between a release position and an engagement position, said coupling latch producing a load-transmitting connection between the belt shaft and belt drive when in its engagement position and moving forcibly controlled out of the engagement position and into the release position at the conclusion of the coupling movement.

A seat-belt tensioner having the above features is described in EP 0 737 606 A1. If, in this type of seat-belt tensioner, the drive connection between the belt drive and belt shaft is established only by activating a coupling so that the belt shaft can rotate unobstructed in normal operation, then this condition of unobstructed rotatability of the belt shaft must also be again ensured after a coupling step has occurred so that, in the event that the seat-belt tensioner has been equipped with a

force-limiting device for example, this device can exercise its effect unimpaired following the coupling step. In the known seat-belt tensioner, a cage is detachably fastened to the housing to develop the forcibly controlled return of the coupling latch out of its load-transmitting engaged state into its release state, this cage being provided with both insertion surfaces and drive-out surfaces that respectively cooperate with trigger ramps and drive-out ramps configured on the coupling latches.

The known seat-belt tensioner has the disadvantage that the design of the cage with different control surfaces on the one hand and the design of ramps of different fitting arrangements on the coupling latches on the other hand is complicated and costly to manufacture and assemble, so that the invention addresses the problem of simplifying the drive-out of the coupling latch after the coupling step has terminated in a seat-belt tensioner having features of the type in question.

The solution of this problem, including advantageous embodiments and further developments of the invention, emerges from the content of the claims that follow this description.

In the basic concept of the invention, an inertial mass is mounted on the belt shaft, this inertial mass being rotationally arranged in relation to the belt shaft and being rotationally displaced in the direction of winding when the belt drive is released from the belt shaft, and that the coupling latch is coupled to the inertial mass in such a manner that the inertial mass, which runs behind and has a greater rotational speed than the belt shaft at the end of the coupling step, drives the coupling latch out of its engagement position. The invention is associated with the advantage that, as additional components for the return of the coupling latch at the termination of the

coupling step, only the inertial mass must be provided and mounted, whereby a suitable actuating member for cooperating with the inertial mass must be provided on the coupling latch. This ensures a simpler construction of the tensioner coupling, even from the viewpoint of an active return of the coupling latch after the end of the coupling step.

In a concrete embodiment, the invention provides that the coupling latch, which is radially arranged to swing between the release position and engagement position, engages a radial cam arranged in the inertial mass using a pin located at an axial distance from the coupling latch. In addition to the additional disk cam already mentioned, it is only necessary to attach the pin to the coupling latch. This will not significantly increase the cost of adapting the tensioner coupling.

It can be provided that the radial cam is arranged in the inertial mass with such a shape that, after the release of the belt drive, the pin of the coupling latch, this pin being located in the radial cam and the coupling latch having been driven out of its engagement position, takes along and accelerates the inertial mass in the direction of winding of the belt shaft, and that the pin migrates into the radial cam until reaching an end position when the rotational speed of the belt shaft slows down, thereby radially swinging the coupling latch from the engagement position into the release position.

The drawing depicts an exemplary embodiment of the invention, which is described below. The drawing shows:

Figure 1 the coupling side of a seat-belt tensioner comprising belt shaft and belt drive pulled apart in the drawing,

Figure 2 the seat-belt tensioner in assembled state when the belt shaft and belt drive are engaged.

The belt shaft 10 visible in Figure 1 has a shaft extension 11, which in turn consists of a coupling neck 12 and a mounting extension 13 attached radially thereto.

A belt drive configured as a drivewheel 25 is rotationally mounted on the coupling neck 12 of the shaft extension 11, whereby the drivewheel demonstrates dome-shaped recesses, indicated by 26, for accommodating drive bodies (not illustrated), preferably mass spheres. A sphere tensioner as belt drive for the belt shaft 10 is adequately known from the prior art.

A coupling latch 14, which demonstrates a mounting region 15 and an engagement region 16, is arranged between the central mounting recess 27, by which the drivewheel 25 is mounted on the coupling neck 12 of the belt shaft 10, and the coupling neck 12. A recess 17 for accommodating the coupling latch 14 is disposed on the inside wall of the drivewheel 25 that surrounds the mounting recess 27, and this recess is dimensioned in such a way that the coupling latch 14 lies in the non-engagement position in the recess 17 so that the coupling neck 12 of the belt shaft 10 can rotate freely in the mounting recess 27 of the drivewheel 25.

To produce the coupling connection between belt shaft 10 and drivewheel 25, the perimeter of the coupling neck 12 of the belt shaft 10 is provided with a notch 18 to accommodate the engagement region 16 of the

coupling latch 14 so that the mounting region 15 engages the notch 18 of the coupling neck 12 when the coupling latch 14 swings out of its position in the recess 17, so that the coupling latch braces itself between recess 17 and notch 18, thereby producing the coupling connection.

An inertial mass 19 is rotationally mounted on the mounting extension 13 axially next to the drivewheel 25, this inertial mass demonstrating a radial cam 20 which is engaged by a pin 21 located at an axial distance from the coupling latch 14. In its rest position, the inertial mass 19 is arranged in such a manner that the pin 21 rests on the end of the radial cam 20, thereby fixing the coupling latch in the recess 17 and thereby out of engagement with the notch 18.

If the drivewheel 25 rotates when the tensioner device is released, then this relative motion relative to the inertial mass 19, which is still standing still, will result in an immediate swinging of the coupling latch 14 and its engagement with the mounting region 15 in the notch 18. The coupling connection produced in this manner converts the further rotation of the drivewheel 25 into rotation in the same direction as that of the belt shaft 10. If the rotational speed of belt shaft 10 and drivewheel 25 declines at the end of the coupling step, then the inertial mass 19 will continue to rotate with approximately constant speed because of its inertia, so that the pin 21 of the coupling latch 14 relocates within the radial cam 20 at the other end of the radial cam as the relative speed between belt shaft 10, drivewheel 25 and inertial mass 19 increases. This brings the coupling latch 14 actively out of engagement with the notch 18 of the coupling neck 12 and returns it back into position outside the recess 17.

The features of the subject matter of these documents disclosed in the present description, claims, abstract and drawing may be essential to the realization of the invention in its various embodiments both individually and in arbitrary combinations with each other.